

Test Report

Report No.: MTi221114020-05E1

Date of issue: 2022-12-07

Applicant: NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD

Product: CEM (Central electronic control module)

Model(s): CEM, CEM 100M, CEM 1000M

FCC ID: 2A7V5-CEM

Shenzhen Microtest Co., Ltd.

<http://www.mtitest.com>

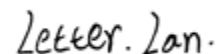
Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.
2. The test results in this test report are only responsible for the samples submitted
3. This test report is invalid without the seal and signature of the laboratory.
4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.
5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.


Table of contents

1. General Description	5
1.1 Description of the EUT	5
1.2 Description of test modes	6
1.3 Description of support units	6
1.4 Environmental conditions	6
1.5 Test setup	7
2. Measurement uncertainty	8
3. Test laboratory	8
4. Summary of Test Result	9
5. List of test equipment	10
6. Test Results	11
6.1 Antenna requirement	11
6.2 Radiated emissions	12
6.3 Occupied bandwidth	19
Photographs of the test setup	20
Photographs of the EUT	20

Test Result Certification	
Applicant:	NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD
Address:	No. 668, Caihong Road, Zhangjiagang Economic and Technological Development Zone, Suzhou, Jiangsu, P.R. China
Manufacturer:	NOBO AUTOMOTIVE TECHNOLOGIES CO., LTD
Address:	No. 668, Caihong Road, Zhangjiagang Economic and Technological Development Zone, Suzhou, Jiangsu, P.R. China
Product description	
Product name:	CEM (Central electronic control module)
Trademark:	Great Wall Motors
Model name:	CEM
Series Model:	CEM 100M, CEM 1000M
Standards:	FCC 47 CFR Part 15 Subpart C
Test method:	ANSI C63.10-2013
Date of Test	
Date of test:	2022-11-11 ~ 2022-12-07
Test result:	Pass

Test Engineer :


(Letter Lan)

Reviewed By: :


(Leon Chen)

Approved By: :


(Tom Xue)

1. General Description

1.1 Description of the EUT

Product name:	CEM (Central electronic control module)
Model name:	CEM
Series Model:	CEM 100M, CEM 1000M
Model difference:	All models have the same Circuit diagram, PCB layout and all electrical construction. CEM: Both 100 Mbit Ethernet and 1000Mbit Ethernet are supported CEM 100M: Only 100 Mbit Ethernet is supported CEM 1000M: Only 1000 Mbit Ethernet is supported
Electrical rating:	Input: DC 13.5V
Accessories:	N/A
Hardware version:	AB
Software version:	AJ
Test sample(s) number:	MTi221114020-05S1001
RF specification:	
Operation frequency:	125 kHz
Modulation type:	Load modulation
Antenna type:	External antenna

1.2 Description of test modes

All the test modes were carried out with the EUT in normal operation, the final test mode of the EUT was the worst test mode for emission test, which was shown in this report and defined as:

No.	Emission test modes
Mode 1	TX mode

1.3 Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

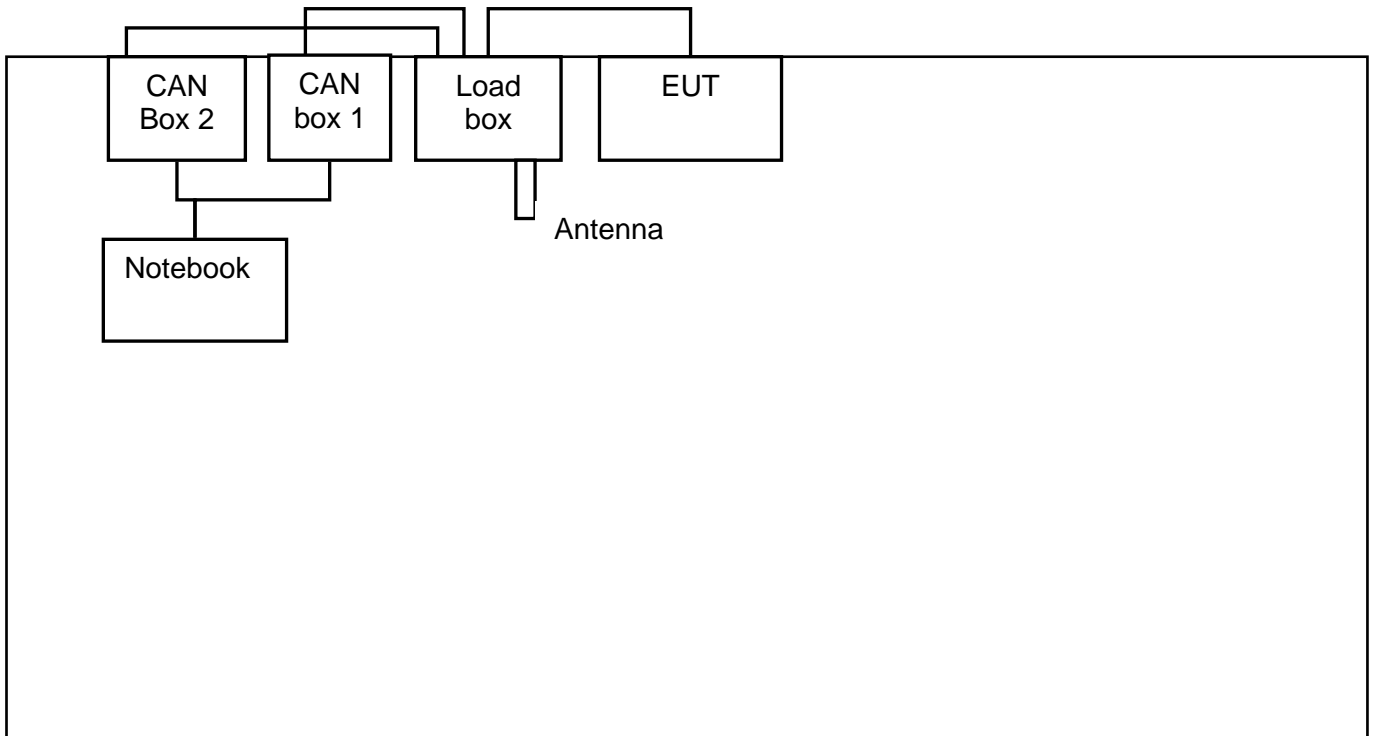
Support equipment list			
Description	Model	Serial No.	Manufacturer
Load box	/	/	NOBO
CAN BOX	CFD5612-G	SZ8B0005	Sapa
CAN BOX	CANFD-200U	8101004052006230012	ZCANPRO
Notebook	Wei 6 14 ITL	MP25LVD5	Lenovo
Support cable list			
Description	Length (m)	From	To
USB cable	1.5	CAN BOX	Notebook
USB cable	1m	CAN BOX	Notebook

1.4 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15°C~35°C
Humidity:	20 % RH ~ 75 % RH
Atmospheric pressure:	98 kPa~101 kPa

1.5 Test setup



The EUT is power by battery, the load box is used to simulate the EUT working status, and the antenna is though the load box connects to the EUT.

2. Measurement uncertainty

Measurement	Uncertainty
Radiated emission (9 kHz ~ 30 MHz)	$\pm 4.3\text{dB}$
Radiated emission (30 MHz~1 GHz)	$\pm 4.7\text{ dB}$
Radiated emission (above 1 GHz)	$\pm 5.3\text{ dB}$
Occupied bandwidth	$\pm 3\%$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

3. Test laboratory

Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573

4. Summary of Test Result

No.	FCC reference	Description of test	Result
Emission			
1	FCC Part 15.203, 15.204	Antenna requirement	Pass
2	FCC Part 15.207	AC power line Conducted emissions	N/A
3	FCC Part 15.209	Radiated emissions	Pass
4	FCC Part 15.215	Occupied bandwidth	Pass

Notes:

N/A means not applicable.

The EUT only employs battery power for operation, which is designed for vehicle use.

5. List of test equipment

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
MTI-E043	EMI test receiver	R&S	ESCi7	101166	2022/05/05	2023/05/04
MTI-E045	Horn antenna	Schwarzbeck	BBHA9120D	9120D-2278	2021/05/30	2023/05/29
MTi-E120	Broadband antenna	Schwarzbeck	VULB9163	9163-1419	2021/05/30	2023/05/29
MTi-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00066	2021/5/30	2023/5/29
MTi-E121	Pre-amplifier	Hewlett-Packard	8447D	2944A09365	2022/04/15	2023/04/14
MTi-E123	Pre-amplifier	Agilent	8449B	3008A04723	2022/05/05	2023/05/04
MTi-E122	MXA signal analyzer	Agilent	N9020A	MY54440859	2022/05/05	2023/05/04

Note: the calibration interval of the test equipment is 12 or 24 months and the calibrations are traceable to international system unit(SI)

6. Test Results

6.1 Antenna requirement

FCC 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

FCC 15.204(b): A transmission system consisting of an intentional radiator, an external radio frequency power amplifier, and an antenna, may be authorized, marketed and used under this part. Except as described otherwise in this section, when a transmission system is authorized as a system, it must always be marketed as a complete system and must always be used in the configuration in which it was authorized.

Description of the EUT antenna

The antenna of EUT is external antenna, which always be marketed as a complete system, and cannot be replaced by user.

6.2 Radiated emissions

6.2.1 Limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note 1: the tighter limit applies at the band edges.

Note 2: the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:

When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10, the tests shall be performed in the frequency range shown in the following table:

Frequency range of measurements for unlicensed wireless device

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Frequency range of measurements for unlicensed wireless device with digital device

Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency range of measurement
Below 1.705 MHz	30 MHz
1.705 MHz to 108 MHz	1000 MHz
108 MHz to 500 MHz	2000 MHz
500 MHz to 1000 MHz	5000 MHz
Above 1000 MHz	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Test instrument setup

Frequency	Test receiver / Spectrum analyzer setting
9 kHz ~ 150 kHz	Quasi Peak / 200 Hz
150 kHz ~ 30 MHz	Quasi Peak / 9 kHz
30 MHz ~ 1 GHz	Quasi Peak / 120 kHz

6.2.2 Test Procedures

The EUT is placed on a non-conducting table 80cm above the ground plane for measurement below 1 GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10-2013.

For measurement below 1 GHz, the resolution bandwidth is set as item 5.4.2.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4m meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and horizontal positions.

Special requirements for 9 kHz to 30 MHz:

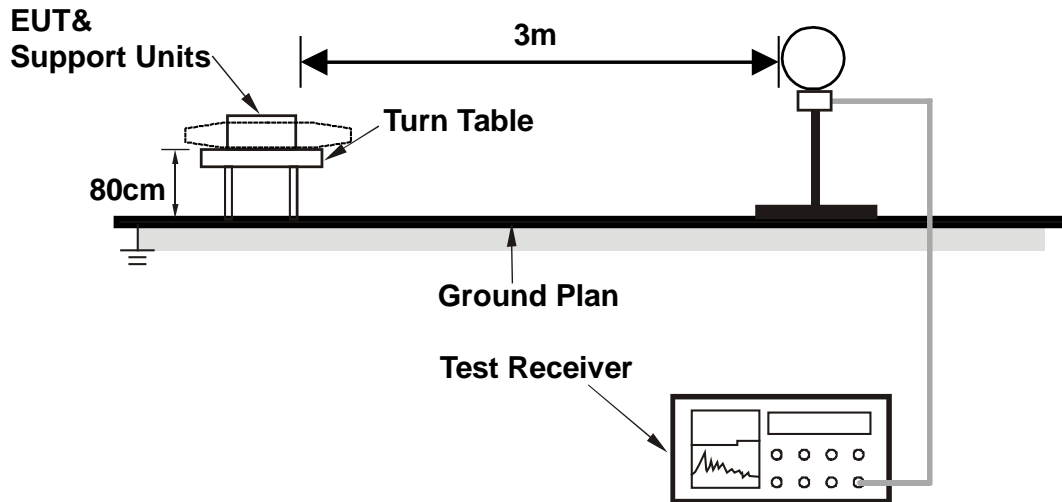
The lowest height of the magnetic antenna shall be 1 m above the ground

When the EUT contains a loop antenna that can only be placed in a vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, and then orthogonal to the axis. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable.

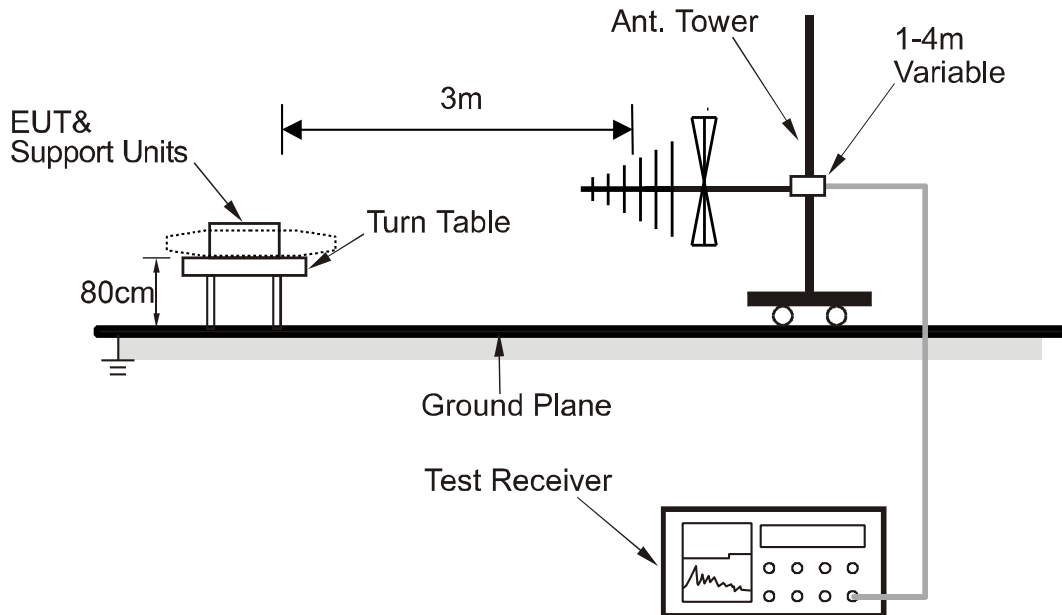
When the EUT contains a loop antenna that can be placed in a horizontal or vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, orthogonal to the axis, and then with the measurement antenna horizontal. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable.

6.2.3 Test Setup

Below 30 MHz:



Below 1 GHz:



For the actual test configuration, please refer to the related item – Photographs of the test setup.

6.2.4 Test result

Calculation formula:

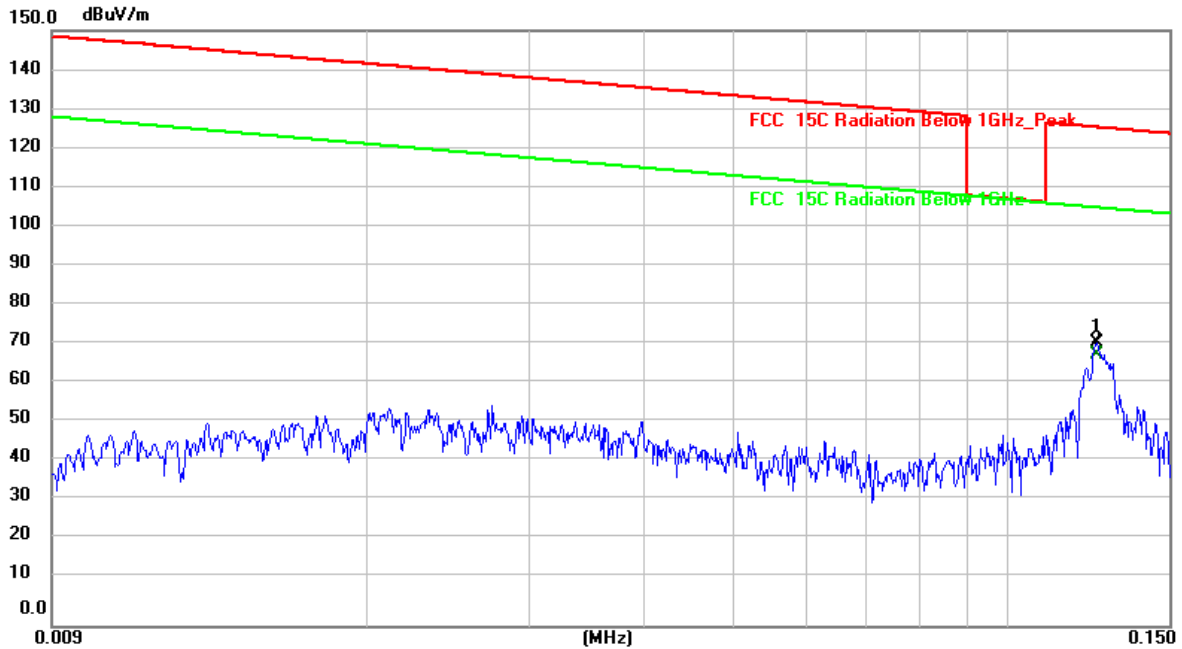
Measurement (dB μ V/m) = Reading Level (dB μ V) + Correct Factor (dB/m)

Over (dB) = Measurement (dB μ V/m) – Limit (dB μ V/m)

Note: For 9 kHz - 30 MHz testing, all the required orthogonal orientations of the measurement loop antenna were performed for pre-scan, the maximum radiated transmissions (Site axis) were recorded.

Frequency 9 kHz ~ 150 kHz

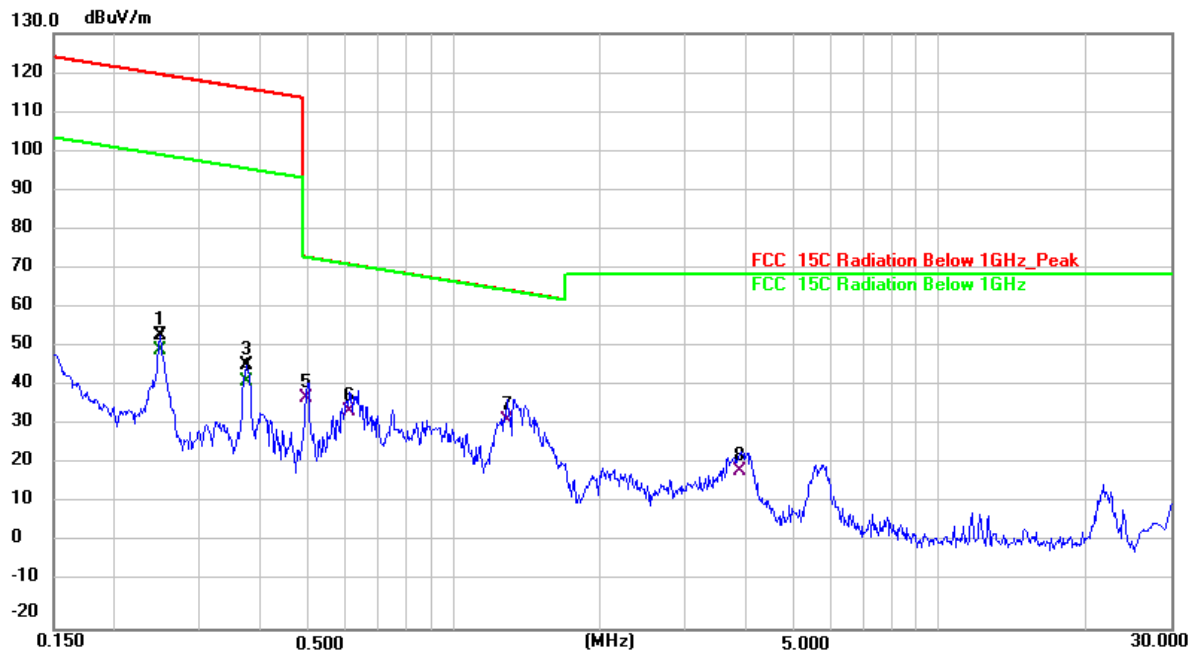
Test mode:	Mode 1	Polarization:	Site axis
Power supply:	DC 13.5V	Test site:	RE chamber 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1		0.1250	75.51	-3.91	71.60	125.6	-54.09	peak
2	*	0.1250	72.19	-3.91	68.28	105.6	-37.41	AVG

Frequency 150 kHz ~ 30 MHz

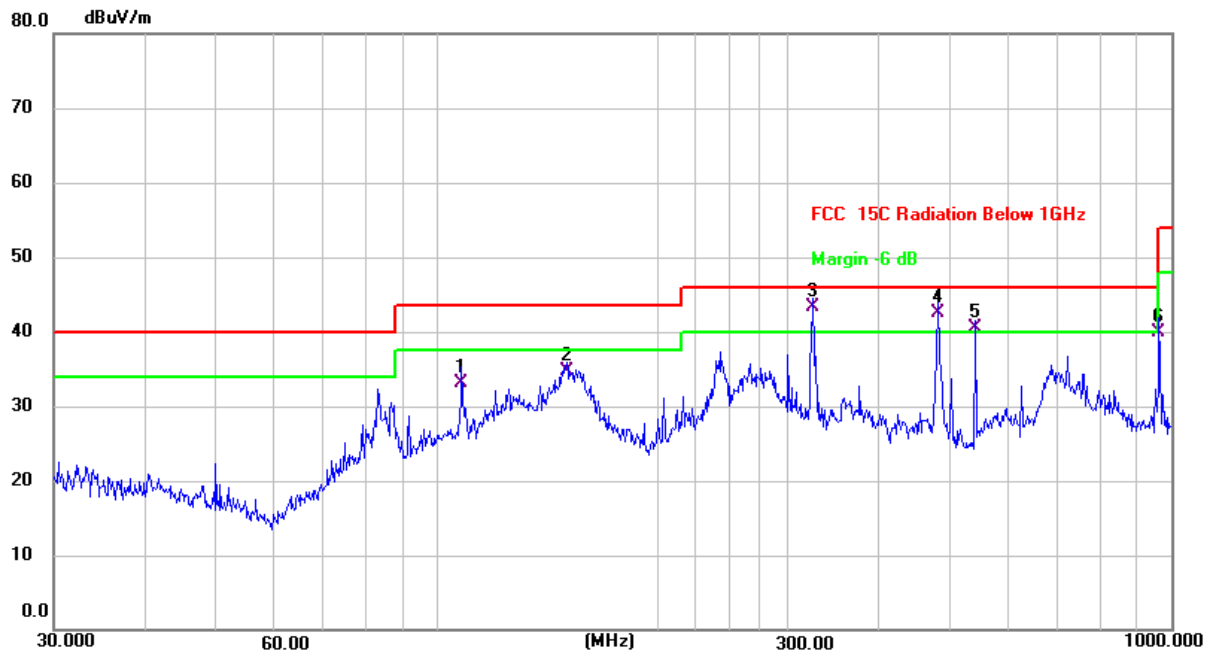
Test mode:	Mode 1	Polarization:	Site axis
Power supply:	DC 13.5V	Test site:	RE chamber 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		0.2482	58.64	-4.45	54.19	119.7	-65.53	peak
2		0.2482	54.63	-4.45	50.18	99.72	-49.54	AVG
3		0.3734	51.59	-5.08	46.51	116.1	-69.65	peak
4		0.3734	47.56	-5.08	42.48	96.16	-53.68	AVG
5		0.4994	43.83	-5.70	38.13	73.64	-35.51	QP
6		0.6108	40.50	-5.70	34.80	71.89	-37.09	QP
7	*	1.2892	38.49	-5.68	32.81	65.42	-32.61	QP
8		3.9014	25.19	-5.42	19.77	69.50	-49.73	QP

Frequency 30 MHz ~ 1 GHz

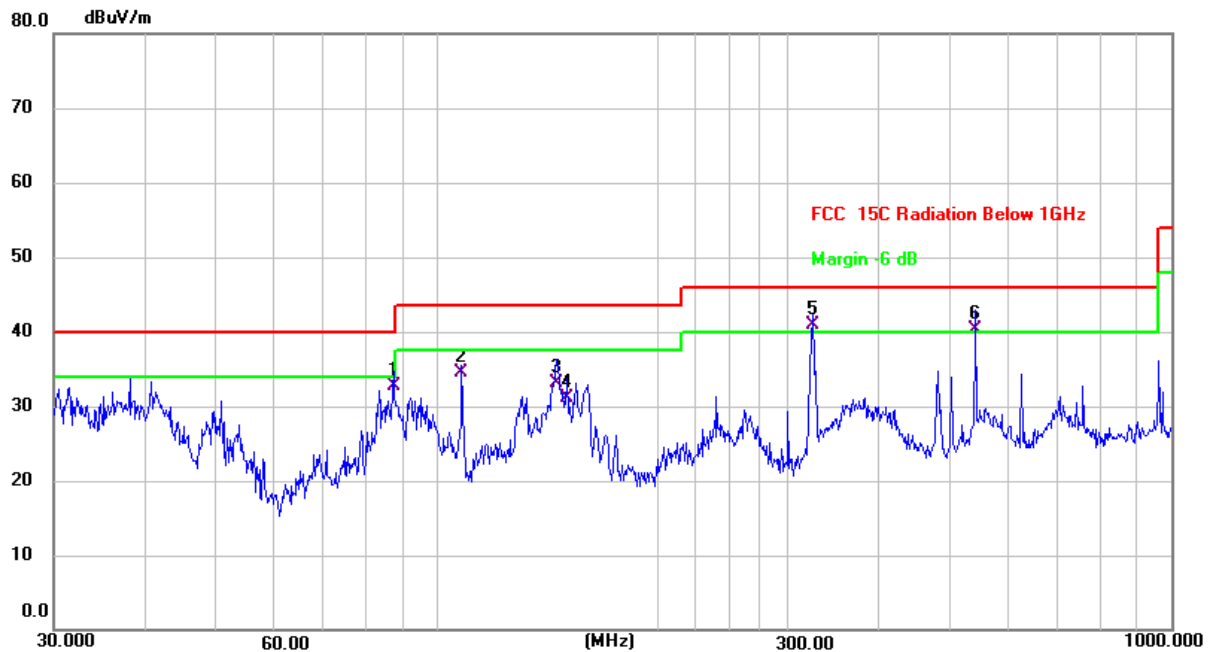
Test mode:	Mode 1	Polarization:	Horizontal
Power supply:	DC 13.5V	Test site:	RE chamber 2



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		107.8877	43.83	-10.63	33.20	43.50	-10.30	QP
2		150.0108	47.17	-12.37	34.80	43.50	-8.70	QP
3	*	324.4561	50.24	-6.94	43.30	46.00	-2.70	QP
4	!	480.5276	48.46	-5.96	42.50	46.00	-3.50	QP
5	!	541.3725	44.94	-4.44	40.50	46.00	-5.50	QP
6		962.1623	39.29	0.61	39.90	54.00	-14.10	QP

Frequency 30 MHz ~ 1 GHz

Test mode:	Mode 1	Polarization:	Vertical
Power supply:	DC 13.5V	Test site:	RE chamber 2



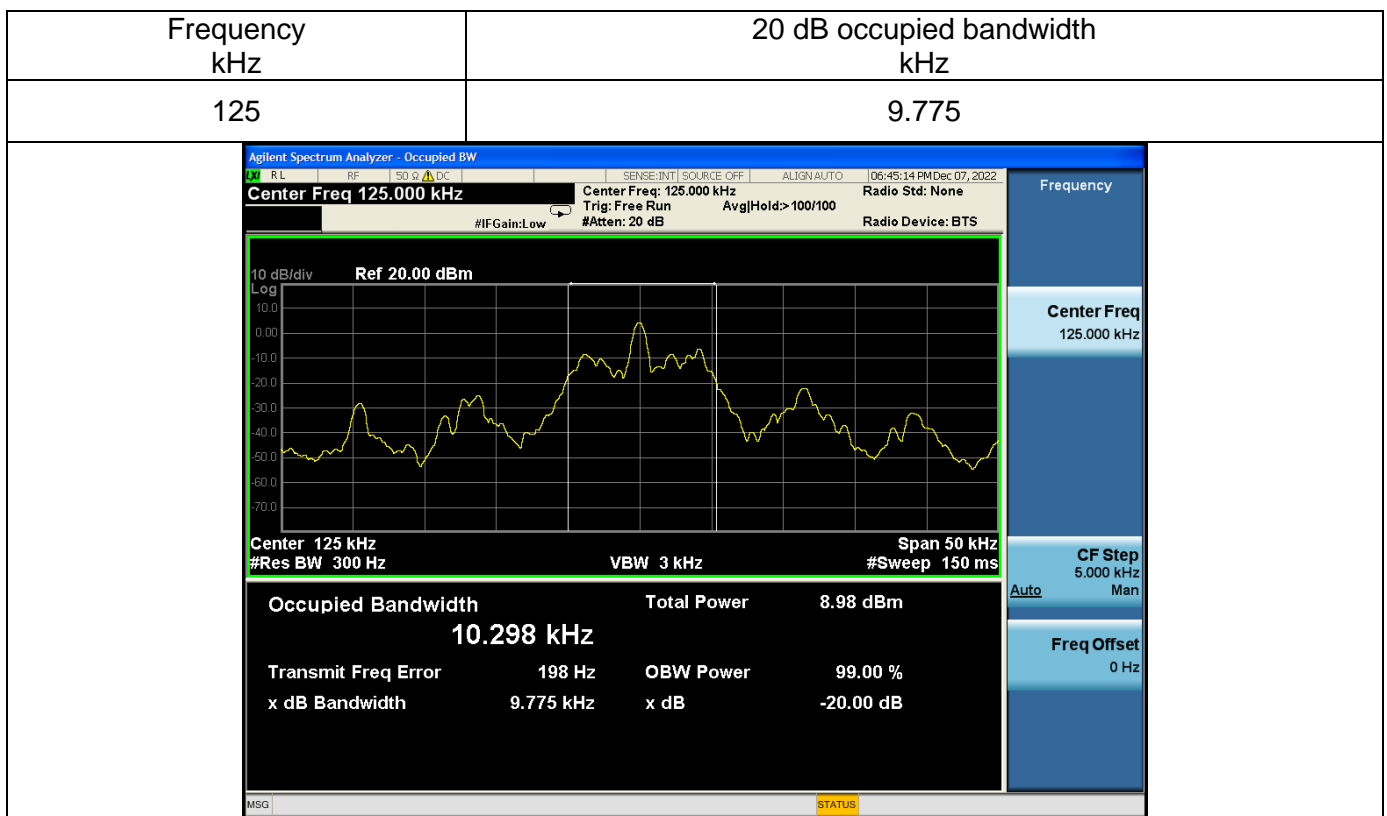
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		87.1117	43.64	-10.94	32.70	40.00	-7.30	QP
2		107.8877	45.13	-10.63	34.50	43.50	-9.00	QP
3		145.3506	45.80	-12.60	33.20	43.50	-10.30	QP
4		150.0108	43.57	-12.37	31.20	43.50	-12.30	QP
5	*	324.4561	47.84	-6.94	40.90	46.00	-5.10	QP
6	!	541.3725	44.74	-4.44	40.30	46.00	-5.70	QP

6.3 Occupied bandwidth

6.3.1 Test Procedures

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation.
- The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement
- Set detection mode to peak and trace mode to max hold.
- Determine the “-xx dB down amplitude” using [(reference value) - xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

6.3.2 Test Result



Photographs of the test setup

See the Appendix – Test Setup Photos.

Photographs of the EUT

See the Appendix - EUT Photos.

----End of Report----